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upon the energy and industry of Dr. Urbina, and is unquestionably the best production of its kind which has issued from Mexico. It will doubtless stimulate local interest among Mexican botanists, but for several reasons can assist but little the foreign students of the Mexican flora. It is far from being a complete enumeration of the known species of the country, and its extent is determined neither by geographic boundaries nor by the limits of natural orders, but rather by chance, since, as it appears, only such species are mentioned as happen already to be represented in the Museo Nacional. A valuable feature of the catalogue is the introduction of a considerable number of local vernacular plant names which, now that they are coupled with their Latin equivalents, may well give clues to the real identity of various Mexican drugs and officinal plants which reach our museums in no condition for botanical determination. B. L. R.

**Recent Contributions to Morphology of the Higher Plants.<sup>1</sup>—**

The high standing of Professor Goebel and his many important contributions to the morphology of the higher plants makes the present work of great interest to botanical students everywhere. The volume at hand is the first of a series which promises to give a comprehensive summary of what may, perhaps, be termed “developmental morphology,” which seems to be about what Goebel means by Organography.

This first volume deals with general Organography, or a general consideration of the members which make up the vegetable organism, their origin and modifications. In the preface attention is called to the great changes which have taken place in regard to morphological questions. The old idealistic conception of “morphologically equivalent” organs as structures which are patterned after an imaginary “type” has been replaced by the idea of homologous structures which are really genetically related. Goebel also insists, and very justly, that no sound system of morphology can be based upon the use of a single character, but that all factors must be taken into account; and, as has already been pointed out by him in his previous studies, the impossibility of divorcing absolutely morphology and physiology is here emphasized. In his zeal as to the importance of determining the causes which directly influence plants as they at present exist, he is perhaps a little too severe on those botanists who

<sup>1</sup> *Organographie der Pflanzen, Erster Teil, Allgemeine Organographie.* Dr. K. Goebel, Professor of Botany in the University of Munich. Jena, Gustav Fischer, 1898.

yield to the fascination of phylogenetic studies. When, for example, he says, "It seems to me that the recognition of the factors which make one side of a leaf larger than the other is of more importance than the building up of a phylogenetic structure from unsupported hypotheses," there is an implication of the futility of *all* phylogenetic speculation which we feel is scarcely warranted.

While the first section of the book ("Allgemeine Gliederung des Pflanzenkörpers") takes into account the morphology of the Thallophytes, the rest of the work is confined to a discussion of the Archegoniates and Spermatophytes. The question of the province of morphology is treated at length, and very clearly, in the first section. The impossibility of clearly separating structure and function is emphasized, and the difficulties in absolutely distinguishing homologies and analogies are pointed out. As he very clearly shows, it is perfectly evident that the same result has been brought about in much the same way in widely divergent stocks. For instance, while the leaves of such an anacrogynous liverwort as *Fossombronia*, and those of an acrogynous form like *Jungermannia* are doubtless homologous in the sense that they bear the same relation to the apical cell of the shoot, nevertheless there is every reason to believe that they have developed quite independently of each other.

In classifying the fundamental organs of plants, Goebel divides them first into two categories, vegetative and reproductive organs. In view of the difficulties of limiting the definitions of stem (caulome) and leaf (phyllome) in the vascular plants, our author regards these as modifications of a common fundamental structure, the shoot (Spross), while the root is the second of the two primary vegetative structures. Hairs (trichomes) and "emergences" are considered as appendages merely of the two fundamental structures. While, of course, the stem and leaves of the higher seaweeds and mosses are recognized as not being the homologues of those of the vascular plants, still Goebel does not think it best to adopt new names for these structures.

The second group of fundamental structures, the reproductive organs, are of two kinds, sporangia (or sporogonia) and sexual organs, antheridia and archegonia (or oögonia). Goebel was perhaps the first botanist to show that the sporangia of the ferns, for instance, are in no proper sense to be considered as modifications of structures once vegetative in nature, but that they, as well as the sexual organs, must be considered as fundamental structural types. The whole trend of the conclusions, based upon the most recent study of the

archegoniates, is that the sporogenous structures of the sporophyte are older than the vegetative ones.

The discussion of the division of labor and development of special organs in the Thallophytes is treated clearly and interestingly, but offers nothing especially new.

The section dealing with the question of cohesion and reduction of parts is clearly presented, and Goebel, like most students who have made a practical study of developmental morphology, recognizes the absurdity of assuming that all simple flowers such as many apetalous Dicotyledons and the lower Monocotyledons like the Araceæ and Naiadaceæ are necessarily reduced from some forms with more complex flowers — a relic of the old metaphysical notion of a "typical flower" to which all other types must be made to conform.

The second division of the volume deals with the question of symmetry in the plant-body. It is treated at length and the author brings up many interesting points, especially those dealing with the causes and significance of bilaterality or dorsi-ventral symmetry in shoots and leaves, as well as zygomorphy in flowers. In regard to the latter point, he concludes that we are not much nearer to understanding the mechanism by which they have been produced than were Sprengel and De Candolle. All we know is that they are in most cases associated with cross-fertilization, and that zygomorphic flowers are always lateral in origin.

The most interesting part of the book is the portion dealing with the changes in the character of the organs of the plant, especially the leaves, as the plant develops from its earlier stages to maturity. Goebel has already published several very important contributions to this most interesting subject, but he adds here a good deal that has not before appeared, and at the same time includes a summary of the more important results of his earlier investigations, especially with regard to the changes in the form of leaves and the significance of these early leaf-forms. Perhaps the most important of the new types brought forward here is that of certain tropical Aroids, especially some of the climbing forms. These striking plants are very conspicuous in the American tropics. Goebel made a special study of some of these and found that in their earlier stages of growth they had simple, sessile leaves, closely overlapping and completely concealing the stem. The flowering shoots, however, lose the dorsi-ventral character, and the much larger and often variously cut leaves, *e.g.*, *Philodendron*, are borne upon long petioles. It appears that

these immature forms have been propagated in greenhouses under various names, "Pothos," "Marcgravia,"—very much as the early shoots of *Thuja*, with the needle-shaped leaves, were for so long supposed to belong to a special genus, *Retinospora*.

The reversion to the primitive leaf-forms in the seedlings and sometimes in older shoots of various water-plants and xerophytes is discussed at length, and their bearing upon the questions of the origin and affinities of these plants is admirably set forth.

The fourth division of the work deals with malformations of various kinds, discussing in a very suggestive way their cause and significance. Goebel believes that the explanation of Sachs, who assumes that specific chemical substances are developed which determine the character of the various organs, is the most plausible one yet brought forward. Goebel's explanation of the reason why malformations, especially the transformation of one organ into another, are so much commoner in the flowers than in the other organs of the plant, *e.g.*, the roots, is because the young organs of the flower are formed in rapid succession, and close together, so that the specific substances properly belonging to one organ are more likely to reach one of another kind, thus producing a more or less transitional form. To quote from our author: "If, for instance, molecules of such substances as induce anther-formation should stray even by the thousandth part of a millimeter from their path, or should be checked or hastened in their transportation to the growing point of the flower, there would thus result a more or less complete transformation of the petals or carpels into stamens."

Goebel also quotes from Sachs to show that the latter conceives these "blütenbildende" substances to have somewhat the character of ferments, an extremely small quantity having power to affect large masses of plastic substance. A similar character is attributed by Beyerinck to what he calls "growth enzymes," produced by gall-forming insects, which so affect the protoplasm of the host-plant as to give rise to the specific gall-form.

While these theories are certainly interesting and not improbable, they seem quite as difficult to prove as the phylogenetic hypotheses, which Goebel in another part of his work seems to think so hopeless.

The last division of the book has to do with the influence of correlation and external stimuli upon the form of the vegetable organism, and presents many interesting details which cannot here be discussed at length.

Every botanist who is interested in morphological problems must

feel grateful to Professor Goebel for the admirable manner in which he has presented them, and all will look forward eagerly to the appearance of the subsequent volumes, which we hope may not be long delayed.

DOUGLAS HOUGHTON CAMPBELL.

STANFORD UNIVERSITY,  
May, 1898.

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### MINERALOGY.

**Genesis of the Diamond.**—Derby<sup>1</sup> has sifted the evidence of the Brazilian deposits bearing on the puzzling and as yet unsolved problem of the origin of the diamond. Three localities are discussed, of as many types.

At the Agua Suja mine, in western Minas Geraes, the diamond-bearing bed is a decomposed conglomerate, both matrix and pebbles having been transformed into clay. The fragments can, however, still be recognized as belonging to the various schists, granites, and sandstones upon which the bed rests, and to basic eruptives, probably members of the nepheline-bearing series of rocks of the region. Weight is placed upon these basic eruptives as suggesting an analogy with the South African deposits; on the whole, however, the differences are more striking than the similarities. The diamond is evidently contained in the cement, not in any constituent of the breccia, and its source cannot even be conjectured with any degree of certainty.

In the mines of Diamantina and those of Grao Mogôl, all in Minas Geraes, which are the oldest and best known of the Brazilian fields, the diamonds occur in a quartzose rock known as itacolumite. There are two types of this rock, a schistose form, and a massive variety which the writer believes is clearly clastic, and later than the schistose form, resting unconformably upon it. Probably both types of the rock are clastic, but both are largely metamorphosed, and it is impossible to say whether the diamond is a local product of that metamorphism or was introduced as a clastic element.

The third locality described is the mine at São João Chapada, near Diamantina. The description is very full, the place having never been described before, as its interest demands. It consists of a huge open pit, in a mass of clay produced by the complete decomposition of the country rocks. The clays may be differentiated

<sup>1</sup> Brazilian Evidence on the Genesis of the Diamond. *Journ. of Geol.*, vol. vi, p. 121.